July 25, 2011

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage through the Use of Signal Boosters, WT Docket No. 10-4

Dear Ms. Dortch:

Verizon Wireless and Wilson Electronics applaud the Commission's endeavor to adopt rules for the design, installation and use of signal boosters in a manner that will protect wireless networks from interference. In response to the NPRM, Verizon Wireless, V-COMM, a wireless engineering consulting firm, and Wilson have jointly developed a proposal ("Joint Proposal") for the design, operation, and, where necessary, installation of signal boosters in a manner that will better ensure protection against harmful interference.

The Joint Proposal addresses the goals of Commission in this proceeding "to facilitate the development and deployment of well-designed signal boosters" that do not harm wireless networks." It separates signal boosters into three categories: (1) Consumer Boosters, which are small fixed and mobile signal boosters that can purchased, installed and used by consumers; (2) Certified Engineered and Operated ("CEO") Boosters, which are larger, higher powered signal boosters designed for large offices, campuses, and similar settings that require professional installation and close carrier coordination; and (3) Carrier Installed Boosters, which are boosters installed by FCC licensees to operate exclusively on the licensees' frequencies. These distinct categories of boosters are necessary in order to account for differences in the way each category of booster is designed, installed and operated.

The Joint Proposal is memorialized in two documents prepared by V-Comm and attached to this letter. These documents set forth the technical specifications for Consumer Boosters and the framework for approving the use of CEO Boosters. The Joint Proposal fully responds to the Commission request for comment regarding the technical specifications needed to protect wireless from interference from boosters.

The highlights of the Joint Proposal are as follows:

Consumer Boosters

- The specifications for Consumer Boosters are designed to enable signal boosters to be installed by consumers and operated without causing harm to CMRS networks.
- Consumer Boosters may be installed and used by consumers for use in buildings or vehicles.
- The specifications are technology neutral and provide protection to all CMRS network technologies and that are used on Cellular, PCS, AWS and 700 MHz commercial mobile radio frequency bands.
- Consumer Boosters must be FCC Type Certified to meet the specifications set forth in the Joint Proposal.
- Consumer Boosters must be bi-directional RF amplifiers.
- Consumer Boosters must be registered with the licensed carriers, either manually or through a Bluetooth connection to the device.
- Consumer Boosters must not exceed 1 Watt uplink composite power per band of operation and 0.05 Watt downlink composite power per band of operation.
- Consumer Boosters must meet the proposed requirements for antenna gain, emission limits, automatic gain control (AGC), wide band signal design, anti-oscillation protection, in-band noise and base station (BTS) overload limits.

Industry Certified, CEO Boosters

- The CEO Booster proposal would apply to any booster not meeting the Consumer Booster specifications and requirements or not installed by the licensee.
- CEO Boosters must be bi-directional RF amplifiers.
- Standards for CEO Boosters would be developed by industry participants, including industry trade associations, manufacturers, installers, and licensed carriers.
- CEO Booster Systems may support individual or multiple wireless carriers.
- CEO Boosters must be installed and engineered by installers certified by an industry organization according to standards developed by the stakeholders.
- CEO Booster installation must be coordinated, as necessary, by the installer, and records of the installation must be maintained in a database by the installer.

- Because CEO Booster installation and operation would be coordinated with licensees, they would operate under the licensee(s) authority – obviating the need for individual licensing.

- Operators of CEO Booster and Booster systems must provide the appropriate licensee(s) 24 hour contact information so that Boosters may be turned off in the case of interference.

- CEO Boosters and Booster Systems will require acceptable completion of on-site testing.

Licensee Installed Boosters

- Boosters installed by licensees or their authorized installers that operate on the licensee's frequency bands would not be subject to the requirements for Consumer Boosters or CEO Boosters.

Adopting rules consistent with the Joint Proposal is a key part of the framework for Commission action. Verizon Wireless and Wilson look forward to working with the Commission on the Joint Proposal and other issues so that a comprehensive solution can be adopted as soon as possible and in any event before the end of the year.

Sincerely,

VERIZON WIRELESS

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Attachments

ATTACHMENT A

Consumer Booster Specifications for CMRS Spectrum Bands

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July 25, 2011

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Consumer Boosters Specifications for Commercial Mobile Radio Service Bands (Cellular, PCS, AWS & 700MHz Spectrum Bands)

General Requirements

- Consumer Boosters must not cause interference to CMRS base stations or user devices. Consumer Boosters must be FCC Type Certified to meet the specifications listed below. Any boosters not in compliance with these specifications, must be installed, operated and certified by CMRS licensees or certified installers. Consumer Boosters may utilize channel block specific filters, provided that the uplink filter attenuation is equal to or greater than the downlink filter attenuation for frequencies outside the supported channel blocks.
- A Consumer Booster is defined as a bi-directional RF amplifier with associated antenna systems that transmits and receive signals on uplinks and downlink CMRS spectrum bands using an outdoor antenna for transmission and reception to CMRS base station(s) and an indoor or in-vehicle antenna, or direct connection to enhance service for CMRS mobiles, meets all specifications outlined herein, and are registered with licensed carriers. Consumer Boosters do not require industry certification and may be installed and used by CMRS consumers.
- Consumer boosters will be licensed under Part 22 (Cellular), Part 24 (Broadband PCS), and Part 27 (AWS & 700MHz) of FCC rules. Part 90 (PLMR) bands are excluded at this time, and recommended for future consideration after 800MHz re-banding has completed.

Power Limits, Antenna Requirements, and Emission Limits

Power Limits & EIRP Limits

- Uplink: 1 Watt (30 dBm) composite power per band of operation
- Downlink: 0.05 Watt (17 dBm) composite power per band of operation
- Compliance to power limits will measured over intervals of continuous transmission using instrumentation calibrated in terms of an RMS equivalent voltage.

Antenna Requirements

- Antenna system net gain including cable loss of up to 0 dBi is permitted without de-rating adjustments. Higher antenna system gains require per dB power de-rating that limits EIRP to 1 Watt for uplink and 0.05 Watt for downlink composite power per band. Consumer Boosters must be sold and FCC type certified with specified antennas and cables.

Emission Limits

- The booster out of band emissions (OOBE) shall be 6 dB below the FCC's mobile emission limits for the supported bands of operation. This is required to limit the additional emissions caused by the booster into the adjacent bands (which may be a Public Safety band in some cases) such that it will not add more than 1 dB to the input signal's emissions.

Design Requirements

AGC Overload Control

- The Consumer Booster must use automatic gain control (AGC) to prevent booster overload when high input signals are received on the uplink and downlink for protection against booster amplifier overload and exceeding specifications under these conditions. The uplink and downlink AGC dynamic range should be at least the gain of the booster or 30 dB, whichever is less.
- Consumer Boosters that do not have sufficient AGC dynamic range to meet the BTS Overload Gain limits and In band Noise Limits specified below must go into Transmit Power Off Mode. In addition, the booster must have sufficient AGC to meet all specifications including maximum output power and emission limits, otherwise the booster must go into the Transmit Power Off Mode.

Amplifier Design

- Consumer booster amplifiers must be designed for wide band signals with a minimum of 10 dB peak to average ratio (PAR) ratio, such as LTE or WiMax signals.

Anti-Oscillation Protection

- Boosters must be able to detect and mitigate (i.e. via AGC or shut down) any oscillations on uplink and downlink bands, including operations that exceeds any specified limits (i.e. power, emissions, etc.). Oscillation detection and mitigation must occur automatically within 0.3 seconds on the uplink and 1 second on downlink, and remain off for at least one (1) minute before restarting. If after five (5) restarts, the booster must shut off and remain off until manually reset by the device operator.

Requirements for Boosters Having Gain Greater Than 50 dB

- Consumer Boosters with gain greater than 50 dB must meet the following requirements: a.) must provide notice to consumers that they cannot be used in mobile applications, b.) must not use input power voltage of 12 VDC, and c.) must not use RF connector types FME or SMA.[1]

Connector Type Requirements for Mobile Boosters & Antennas

- Boosters and antennas designed for mobile applications must use FME or SMA type connectors.

Requirements for Mobile Boosters Having Gain Greater Than 23 dB

- Consumer Boosters intended for mobile applications having uplink gain greater than 23 dB must provide notice to consumers that a.) they can only be used with

[1] Consumer Boosters with gain greater than 50 dB are reserved for fixed indoor applications only. Specifications for fixed indoor boosters permit higher maximum gains, higher BTS overload gains with increased coupling losses to mobiles, and higher uplink gains in shut off modes than mobile boosters, which would not protect nearby mobiles and base stations from noise and overload limits.

supplied antenna accessories, or b.) they cannot be used with direct connected or coupled antenna accessories.[2]

Requirements for Mobile Boosters Having Gain Greater Than 15 dB

- Consumer Boosters intended for mobile applications having uplink gain greater than 15 dB must provide notice to consumers that a.) they can only be used with supplied antenna accessories, or b.) they cannot be used with direct connected antenna accessories.

Uplink and Downlink Requirements

- Consumer Boosters must be designed to provide equivalent performance for the base station reverse link (uplink) and the base station forward link (downlink) to the mobile devices. One-way boosters (i.e. uplink only, downlink only, uplink impaired, downlink impaired) are not permitted.

Transmitter Requirements, In band Noise Limits, and BTS Overload Limits

Uplink Power Off Mode (Uplink Squelch)

- Consumer Booster that do not receive mobile device transmissions at their uplink input port after a maximum of 15 minutes must either: a.) turn off the booster's uplink transmitter, or (b) limit its uplink noise power output level to -70 dBm/MHz, or (c) reduce its Uplink Noise Power limit to 10 dB below the Uplink Noise Power Limit specified in the section below, which results in the limit: Uplink Noise Power <= -113 dBm/MHz - RSSI.
- The booster's downlink transmitter may remain active in the Uplink Power Off Mode. Sensing algorithms must use RMS detectors and measure uplink signals received a minimum of 4 dB above the noise floor of the sensing receiver for positive identification of mobile device transmissions to activate the booster's uplink transmitter.
- Consumer Boosters with maximum uplink noise power greater than -59 dBm/MHz that do not support the Uplink Power Off Mode must reduce its Uplink Noise Power limit to 10 dB below the Uplink Noise Power Limit specified in the section below, which results in the limit: Uplink Noise Power <= -113 dBm/MHz - RSSI.
- Consumer Boosters with maximum uplink noise power less than -59 dBm/MHz are excluded from the Uplink Power Off Mode requirement.

Transmit Power Off Mode

- In this mode of operation, the Consumer Booster's uplink and downlink transmitters shall be turned off, and not exceed the "Transmit Power Off Limit" specified below. The Transmit Power Off Mode is required when the booster

[2] Mobile Boosters with uplink gain greater than 23 dB cannot be used with antenna couplers, cradles or direct connected mobile devices. Specifications for mobile boosters with in-vehicle antennas permit higher maximum gains (i.e. 50 dB), higher BTS overload gains with increased coupling losses to mobiles, and higher uplink gains in shut off modes than mobile boosters, which would not protect nearby base stations from BTS overload limits.

cannot otherwise meet the specifications defined herein (i.e. for power, emissions, noise, or overload limits).

Transmit Power Off Limit

- When operating in the "Transmit Power OFF Mode", the Consumer Booster transmitters shall be turned off, and not exceed the noise power and gain limits specified below:
  - Uplink & Downlink Noise power <= -70 dBm/MHz
  - Uplink Gain <= 23 dB, for fixed indoor consumer boosters
  - Uplink Gain <= 23 dB, for mobile boosters with antennas
  - Uplink Gain <= 7 dB, for mobile boosters with cradles/couplers
  - Uplink Gain <= 3 dB, for mobile boosters with direct connects.

- The Transmit Power Off Mode protects nearby mobiles from elevated noise floors, and nearby base stations (BTS) from elevated noise levels and overload.

In Band Noise Power Limits

- The Consumer Booster transmitted noise power output at its uplink and downlink ports must not exceed the limits specified below.

  Uplink Noise Power <= -103 dBm/MHz - RSSI

  Noise Power Maximum <= -102.5 dBm/MHz + 20 Log (Frequency)
  (for Fixed Indoor Boosters, for Uplink and Downlink)

  Noise Power Maximum for Mobile Boosters <= -59 dBm/MHz
  (i.e. Max. Gain of 50 dB for UL & DL, for 5 dB Noise Figure Booster)

- Where, RSSI is the downlink composite received signal at the booster input port from the base station. Measurements must contain the total (composite) power received in the supported spectrum band with wideband RMS detectors using peak samples measured over a minimum period of 1 second. Measurements must be performed separately for each band (i.e. Cellular, PCS, etc.) supported by the booster.
- Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz units.
- Consumer Booster's uplink and downlink gains must be within range of each other during active connections to maintain equivalent performance and balance for uplinks and downlinks.[3]
- For example, at the measured downlink composite RSSI of -50 dBm at the booster's input port, the booster's Uplink Noise Power is limited to -103

[3] Consumer Boosters must be designed to provide equivalent performance for the base station reverse link (uplink) and the base station forward link (downlink) to mobile devices when connections are active. When boosters are operating with UL Squelch mode enabled uplink transmissions are reduced when devices are not active.

dBm/MHz - -50 dBm, which limits the Uplink Noise Power to -53 dBm/MHz. The Noise Power Limit is independent of the supported frequency band.

- A booster's transmitted noise power is related to its noise figure and Gain as follows: Noise Power = Thermal Noise (KTB) + Gain + Booster Noise Figure. Varying its uplink and downlink gain varies its transmitted noise power at its uplink and downlink ports. The Uplink Noise Power limit will limit the uplink Gain of the booster as follows. For a consumer booster with an uplink noise figure of 5 dB, downlink RSSI of -50 dBm, and thermal noise of -114 dBm/MHz at room temperature, the uplink Gain would be limited to: Gain <= 6 dB - RSSI, which limits Uplink Gain to 56 dB in this case.
- For example, for fixed indoor consumer boosters the uplink and downlink Noise Power Output Maximum is -37 dBm/MHz for PCS (1880MHz), -38 dBm/MHz for AWS (1730MHz), -44 dBm/MHz for Cellular (835MHz), and -45 dBm/MHz at 750 MHz. For a consumer booster with 5 dB noise figure, this corresponds to the uplink and downlink Maximum Gain of 72 dB for PCS, 71 dB AWS, 65 dB for Cellular, and 64 dB at 750 MHz. The Noise Power Maximum Limit varies by frequency band.
- Consumer Boosters with maximum uplink noise power greater than -59 dBm/MHz that do not support the Uplink Power Off Mode (UL Squelch) must reduce its Uplink Noise Power limit to 10 dB below the Uplink Noise Power Limit specified above, which results in the limit: Uplink Noise Power <= -113 dBm/MHz - RSSI.
- Consumer Boosters that do not have sufficient AGC dynamic range to meet the uplink and downlink Noise Power Limit must go into Transmit Power Off Mode when AGC is exhausted.[4]
- Compliance to this limit is measured in FCC type certification testing, with the peak level within the supported spectrum bands not exceeding the specified limit using a spectrum analyzer employing a resolution bandwidth (RBW) of 1 MHz and RMS detector.

BTS Overload Gain Limits

- The uplink and downlink Gain of the Consumer Booster shall not exceed the limits specified below.

Uplink Gain <= -34 dB - RSSI + MS Coupling Loss

Where, MS Coupling Loss (MSCL) is equal to: [5]

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[4] Consumer Boosters that do not have sufficient AGC dynamic range to meet Noise Power limits must go into Transmit Power Off Mode when AGC is exhausted, which occurs at the downlink RSSI levels: RSSI >= 11 dB - Booster's Noise Figure - Max. Gain of the Booster + Max. AGC of Booster. For example, a fixed indoor booster having a maximum uplink gain of 65 dB, maximum AGC of 30 dB, minimum gain of 35 dB, and uplink noise figure of 5 dB, must shut off at the downlink RSSI of -29 dBm.

[5] The MS Coupling Loss represents the minimum inside net coupling loss from a CMRS mobile to the booster input port, specified as a positive loss value. The losses were derived from measurements at cellular and PCS frequencies with standard antennas and configurations for indoor fixed and mobile applications. For example, for an indoor dome antenna mounted at the ceiling with 20 feet RG58 cable to the booster, the

Fixed Indoor Booster with Dome Antenna: MSCL = 40 dB
Fixed Indoor Booster with Panel Antenna: [6] MSCL = 36 dB
Fixed Indoor Booster w/ Monopole Antenna: MSCL = 36 dB
Mobile Booster with Inside Antenna: MSCL = 23 dB
Mobile Booster with Cradle/Coupler: MSCL = 7 dB
Mobile Booster with Direct Connect: MSCL = 3 dB

Maximum Gain for Fixed Indoor Boosters <= 6.5 dB + 20 Log (Frequency)
(i.e. PCS 72 dB, Cell 65 dB, maximum uplink and downlink gains)

Maximum Gain for Mobile Boosters (for Uplink and Downlink):
With Inside Antennas: Gain <= 50 dB
With Cradle/Couplers: Gain <= 23 dB
With Direct Connects: Gain <= 15 dB

- Where, RSSI is the downlink composite received signal at the booster input port from the base station (BTS). Measurements must contain the total (composite) power received in the supported spectrum band with wideband RMS detectors using peak samples measured over a minimum period of 1 second. Measurements must be performed separately for each band (i.e. Cellular, PCS, etc.) supported by the booster.
- Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz units.
- Where, the Maximum Gain for fixed and mobile boosters is the limit for uplink (UL) and downlink (DL) directions.
- Consumer Booster's uplink and downlink gains must be within range of each other during active connections to maintain equivalent performance and balance for uplinks and downlinks.[7]
- For example, at the measured downlink composite RSSI of -50 dBm at a fixed indoor booster's input port, with dome antenna MS Coupling Loss of 40 dB, the Uplink Gain <= -34 dB - -50 dBm + 40 dB, which limits the Uplink Gain to 56. The BTS Overload Gain Limit is independent of the supported frequency band.
- For the fixed indoor booster with dome antenna (MS Coupling Loss = 40 dB), the overload Uplink Gain is limited to -34 dB - RSSI + 40 dB, which is equal to 6 dB - RSSI. This is equal to the uplink gain limit for a 5 dB Noise Figure booster from the Uplink Noise Power limit. For all other booster and antenna cases, the MS Coupling Loss is less than 40 dB, and the BTS Overload's Uplink Gain limit

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minimum measured coupling loss to a 1/4 wave antenna (0 dBi) at 5 feet above floor level was 37 dB for cellular and PCS frequencies, with 3 dB user body/head/misc. loss, is equal to MS Coupling Loss = 40 dB.

[6] Fixed indoor booster systems with panel, monopole or dipole antennas must a.) provide notice to consumers that antenna installations must maintain a minimum 6 foot standoff from CMRS devices or be mounted at ceilings heights, or b.) vendors must assume the MS Coupling Loss of 30 dB.

[7] Consumer Boosters must be designed to provide equivalent performance for the base station reverse link (uplink) and the base station forward link (downlink) to mobile devices when connections are active. When boosters are operating with UL Squelch mode enabled uplink transmissions are reduced when devices are not active.

is more stringent than the uplink gain limited by the Noise Power limit for a booster with noise figure of 5 dB.

- For example, the uplink and downlink Maximum Gain of Consumer Boosters is 72 dB for PCS, 71 dB for AWS, 65 dB for Cellular, and 64 dB at 750 MHz. The Maximum Gain Limit varies by frequency band.
- Low power mobile boosters designed for single user devices with cradles, couplers or direct connects having gains less than 23 dB may increase the BTS Overload Uplink Gain limit when uplink received levels at the booster input exceeds -10 dBm. For every 1 dB above -10 dBm received on uplink, an additional 1 dB can be added to the BTS Overload Uplink Gain limit. Note that all other limits remain unchanged, including Power, Emissions, Noise, Maximum Gain, and Transmit Power Off Limits. Uplink received levels must measured as wideband composite power levels using RMS detectors, averaged over a minimum period of 1 second, and be performed separately for each band supported by the booster.[8]
- Consumer Boosters that do not have sufficient AGC dynamic range to meet the uplink and downlink BTS Overload Gain limits must go into Transmit Power Off Mode when AGC is exhausted.[9]
- Compliance to this limit is measured in FCC type certification testing, using peak Gain values (including amplifier ripple) within the supported bands.

GPS and Registration Requirements

GPS Requirements

- Product labeling requirements include notification to consumers that E911 location information may not be provided to calls served by the booster. Consumer Boosters designed to pass through satellite GPS signals with no interference to CMRS or GPS operations for direct connected or device coupled boosters are excluded from this consumer notification requirement.

Registration

- Consumers are required to register their Consumer Boosters by contacting their CMRS service provider(s), and include the following information: booster model number, FCC ID #, supported frequency band(s), contact name, address, e-mail, and phone number for the licensee's ability to maintain and shut down interfering units as required. Consumers must be notified of registration requirements in user installation manual(s) or other supplied product documentation. Unregistered

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[8] For example, when uplink received levels (UL_RX) at the booster input exceeds -10 dBm, the uplink gain is limited to -34 dB - RSSI + MS Coupling Loss + UL_RX - -10dBm. For the MS Coupling Loss of 7 dB for a booster with cradle, downlink RSSI of -40 dBm, UL_Rx of -5 dBm, the uplink gain is limited to 18 dB. Dual-band and multi-band boosters must measure and perform uplink controls for each band separately (i.e. Cellular, PCS, etc.) supported by the booster.

[9] Consumer Boosters that do not have sufficient AGC dynamic range to meet BTS Overload Gain limits must go into Transmit Power Off Mode when AGC is exhausted, which occurs at the downlink RSSI levels: RSSI >= -34 dB + MS Coupling Loss - Max. Gain of the Booster + Max. AGC of Booster. For example, a mobile booster with cradle has MS Coupling loss 7 dB, a maximum uplink gain of 22 dB, maximum AGC of 20 dB, and minimum gain of 2 dB, must shut off at the downlink RSSI of -29 dBm.

Consumer Boosters would be subject to FCC enforcement and fines. Consumers must be active CMRS customers.

Bluetooth Connection

- As an alternative to registration, a Bluetooth connection and registration can be made between the mobile device and the booster unit for the booster operate.[10] The booster will operate as an extension to an authorized mobile device. When a booster amplifier is controlled by a supported wireless device the following functions are supported: 1.) booster and device information exchange, 2.) booster registration with licensed carrier through wireless device, 3.) device determines whether booster amplifier can support spectrum and technology, 4.) device requests amplifier to turn on and off, 5.) device provides information to the booster to change spectrum bands as required for mobile operation.

FCC Type Certification for Consumer Boosters

- Compliance to all specifications listed herein is required. Consumer Boosters must be FCC type certified to meet these specifications and include installation manual(s) with specified antennas and cables. Type certified boosters must display the FCC ID number.
- Compliance to power and emission limits require using input signals on standard frequency assignments for all bands supported by the booster, and must utilize source signals with a minimum of 1 MHz occupied bandwidth and having a minimum peak-to-average (PAR) ratio of 10 dB (i.e. LTE or WiMax signals). Compliance to emission limits require input signals on standard frequency assignments at the band edges for all supported bands.
- Certification tests for emissions and output power will be performed at maximum rated output power, and verify AGC prevents booster overload when input exceeds input rated power range.

[10] Bluetooth is a wireless technology standard for exchanging data using radio transmissions in the ISM band from 2400-2480 MHz from fixed and mobile devices, creating personal area networks with high levels of security. Bluetooth is managed by Bluetooth Special Interest Group, which has more than 14,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics.

ATTACHMENT B

FCC WT Docket 10-4
Improving Wireless Coverage
Through the Use of Signal Boosters

Industry Certified Signal Booster Program

Dave Hunt – Senior RF Engineer
Sean Haynberg – Director of RF Technologies

July 25, 2011

Overview

- Introduction
- Summary
- Authorization of CEO Booster Operation
- Certified Engineered and Operated "CEO" Installers
- Proof of Performance
- Booster Equipment and Operation
- Database Information Requirements

Introduction

- Consumer Boosters are not required to meet the requirements of this program for Industry Certified Boosters.
- The Booster Certification Program is a commercial wireless industry accepted program to ensure that non-consumer booster equipment and installations meet minimum performance standards and the installers successfully integrate boosters into the macro network with proper engineering design and coordination pursuant to industry standards.
- For the purposes of this document, a "Booster" is defined as a bi-directional RF amplifier that transmits and receive signals using an outdoor "donor" antenna orientated to a nearby serving CMRS base station and uses an indoor "server" antenna to enhance CMRS coverage indoors. The antenna systems may be distributed via coaxial cable or fiber.
- The proposed name for the certified booster systems are "Certified Engineered and Operated" boosters ("CEO"). They will be able to serve large offices, business, enterprises, etc.
- The technical operating specifications of the CEO boosters will be developed by industry participants including industry trade association, manufacturers, installers, and licensed carriers. From a technical view, CEO system operating specifications are expected to be similar to booster systems installed by wireless carriers. CEO booster systems may support individual or multiple wireless carriers.

Summary

- Certified Boosters will be required to be installed and engineered by certified installers.
- Certified installers will be required to be trained and follow the developed industry standards. They will coordinate with the existing licensees as necessary and maintain a database of information. CEO installers will be required to attend and pass an industry certified test compliance program.
- CEO installers will maintain necessary accepted documentation according industry standards that will be developed for this program, which will include proof of performance, measurements and test results.
- CEO booster systems must be installed, engineered, and operated by companies that are certified by an industry organization such as the CTIA.
- CEO installers must provide and maintain specific booster information when coordinating with licensees and for record keeping.

Authorization of CEO Booster Operation

- The CEO boosters would be authorized to operate through coordination with the supported licensee(s). Entities would not be allowed to operate CEO boosters without carrier authorization.
- CEO installers would be required to coordinate, obtain licensee consent and provide booster database and operating parameters for all bands and licensees' spectrum bands supported by the booster.
- Authorization and operation requests to the licensee must include 24 hour contact information, to turn off boosters in case of interference.
- The booster operator is responsible to the licensed carrier for the technical performance of the system. All interference and traffic engineering issues are coordinated with the licensed carrier .

"Certified Engineered and Operated" Installers

- CEO installers would be required to demonstrated competence in RF engineering booster systems and knowledge of commercial wireless networks and technologies, including an advanced training in RF engineering and certification for CMRS certified booster systems.
- CEO boosters installed must be adjustable with parameters on a license spectrum block basis.
- CEO installers must provide booster information including model #, operating parameters, location, etc. to the database manager and/or licensee(s), which will be maintained in a database for resolution of problems, and for future upgradeability to support new technologies, and to address required re-orientation of donor antennas in cases of newly deployed base stations nearby.
- CEO installers will be required to attend and pass an industry certified test compliance program. This compliance program will mandate test requirements, test plans, test documentation requirements.
- CEO installer certification may be revoked upon failure to comply with industry defined practices and requirements in the compliance program.
- Installer certification must be renewed every five years.
- CEO booster installer and operator must have access to appropriate test equipment for installation and on going operation of the CEO booster system. Booster system calibration information is provided in the CEO database.

Proof of Performance

- CEO installers will properly engineer, install, test and confirm equipment is operating according to developed standards and is operating as authorized by the supported licensed carriers.
- Installations will require acceptable completion of on-site testing, which will include required test plans and documentation, measurements of isolation between donor and server antennas, verification of gain to isolation ratio, measurement of gain and output power levels utilized, coupling measurements to confirm base station noise and overload conditions are not exceeded.
- The industry certified booster will be installed and configured to meet minimum performance specifications for each wireless technology supported as specified by the CMRS licensee(s). Minimum performance standards will be developed with industry engineers and published by industry organizations.

Booster Equipment and Operation

- CEO systems must be engineered and operated by companies that are certified by the specified industry organization.
- They can use a wide range of power levels and technologies.
- Donor antennas must be directional and oriented to nearby base stations as specified by the CMRS licensee(s).
- Operating parameters are adjusted per licensed spectrum block(s).
- CEO systems should be flexible enough to enhance coverage in most locations, while providing for existing licensee base station protection and performance.

Database Information Requirements

- CEO installers must provide booster database information below to the database manager and/or licensee(s).
- Licensees will maintain a booster database for
  - Interference and problem resolution
  - Future upgradeability to support new technologies
  - Address re-orientation of donor antennas toward newer cell sites deployed nearby or as required for traffic engineering.
- Booster database installation & information will include
  - Booster Location (Latitude & Longitude, Street Address, Location within Building, Picture of building)
  - Building and booster installation and configuration information and diagrams (inside and outside equipment and antennas, locations, specifications and operating parameters)
  - Booster Manufacturer, Model, FCC ID #, Operating and Design Parameters

Database Information Requirements (Cont')

- Equipment information including measured cable and component losses, equipment types, models, operating specifications
- Outside Donor antenna description, model, specifications, orientation, location on building, pictures and diagram of antenna and location, Repeater description and location inside of building
- Booster operators contact information (24x7)
- Access requirements for surveying booster equipment and installation
- Software remote control requirements and account security information
- Booster contact information will be used as necessary to confirm installation, operation and maintenance of booster systems in compliance to the program requirements, and in cases of potential interference.

V-COMM is a leading provider of quality engineering and engineering consulting services to the worldwide wireless telecommunications industry with offices in Cranbury, NJ and Blue Bell, PA. V-COMM's engineering staff is experienced in Cellular, Personal Communications Services (PCS), Wireless Broadband Data, Enhanced Specialized Mobile Radio (ESMR), Paging, 2-Way radio, Microwave, and Broadcast Mobile TV networks. We have provided our expertise to wireless operators in engineering, system design, implementation, performance, optimization, and evaluation of new wireless technologies.

We have extensive experience in analyzing interference in various spectrum bands including Cellular, SMR, PCS, AWS, Air-to-ground, Public Safety, and 700 MHz spectrum. We have engineering experience in all commercial wireless technologies, including LTE, HSPA, UMTS, EVDO, CDMA, GSM, WiMAX, DVB-H, and Public Safety wireless technologies including analog and digital Project 25, EDACS, Opensky, and other trunking and conventional radio networks. Further, V-COMM was selected by the FCC & Department of Justice to provide expert analysis and testimony in the Nextwave and Pocket Communications Bankruptcy cases.

For additional information, visit V-COMM's web site at www.vcomm-eng.com.